

## **Experimental evidence of a backward wave in THz LH transmission lines**

T. Crepin, T. Decoopman, X. Mélique, J. F. Lampin and D. Lippens  
Institut d'Electronique, de Microélectronique et de Nanotechnologies  
Université de Lille 1, avenue Poincaré, BP 69  
59652 Villeneuve d'Ascq Cedex, France

Following the demonstration of a left-handed behaviour via Vectorial Network Analysis and numerical phase tracking for a novel transmission line loaded by SRR's [1]-[2], we show here the possibility to propagate a backward electromagnetic wave at Terahertz frequencies.

The propagation structure is made of a Co-Planar Strip line loaded periodically by shunt inductances and series capacitances. The meander-type self-inductances are written by e-beam lithography onto a quartz substrate (Low  $\kappa$ ) whereas the lumped capacitances are fabricated via  $\text{Si}_3\text{N}_4$  thin film technology.

The characterization of lines is carried out via femtosecond laser experiments using Low Temperature Grown (LTG) GaAs probing patches. Under these conditions, the spectrum extends at least up to one Terahertz.

The Interpretation of the time domain measurements have been performed via (i) dispersion characteristics calculations, where the Left-Handed character is shown by the band curvature and (ii) Fourier transform analysis of finite dimension prototypes with clear evidence of a high-pass behaviour and opposite directions of phase and Poynting vectors.

[1] T. Decoopman, O. Vanbésien, and D. Lippens, IEEE Microwave and wireless component Letters, **14**, 507 (2004)

[2] M. Perrin, S. Fasquel, T. Decoopman, X. Mélique, O. Vanbésien, E. Lheurette and D. Lippens, J. Opt. A : Pure Appl. Opt **7**, S3-S11(2005)